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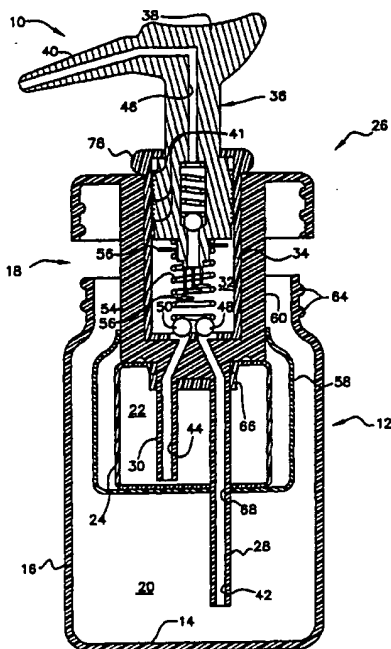
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[Continued on next page]

(54) Title: DISPENSING CONTAINER HAVING BLENDING VALVE



(57) Abstract: A dispensing bottle (12) which stores two or more separated fluids and blends the fluids when dispensing. The bottle has two or more liquid receptacles (20, 22) and a cap (26) which threads to the bottle. The receptacles include the open interior of the bottle, and an interior vessel (24) separate and removable from the bottle. The cap is connected to a mixing circuit which retrieves and blends fluids taken from the receptacles. The mixing circuit includes a pick up tube (28, 30) or equivalent conduit extending to each receptacle, a mixing chamber (32), and check valves (48, 50) preventing backflow of mixed fluids into

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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the storage receptacles. Another check valve (52) prevents return of mixed fluids into the mixing chamber. A proportioning valve (34) adjusts the proportion of the fluids entering the mixing chamber. The bottle has a plunger type pump which propels mixed fluid to a discharge nozzle.

DISPENSING CONTAINER HAVING BLENDING VALVE**BACKGROUND OF THE INVENTION****1. FIELD OF THE INVENTION**

The present invention relates to containers which
5 blend fluent materials stored in separate chambers when
dispensing these materials. More particularly, the
invention sets forth a container incorporating a manual
dispensing pump and a rotatable proportioning valve which
adjusts proportions of the stored materials as they are
10 blended and discharged. The novel dispensing container
finds application wherever fluid materials must be
blended and dispensed in small quantities. For example,
the container may be utilized by consumers to store and
dispense personal care products such as shampoo and hair
15 conditioner, cooking products such as sweeteners and
colorants, and food products such as oil and vinegar for
preparing salad dressings, among others. Alternatively,
the container may be utilized in industrial, commercial,
institutional, medical, and scientific applications to
20 blend active ingredients with carrier fluids, or to blend
ingredients which would interact on contact with one
another. The fields which may benefit from the invention
are many and diverse.

2. DESCRIPTION OF THE PRIOR ART

It is necessary from time to time to dispense several dissimilar fluent substances which must be separated from one another prior to being utilized, yet
5 blended when utilized. In many cases, the precise proportions of the two substances cannot be determined until the last minute. If the two substances were separately stored, it would require extreme care to assure that they are accurately mixed together. Also,
10 metering and dispensing of two separate substances is somewhat time consuming. Furthermore, separate metering and dispensing may expose one or both substances to contact with the air, airborne contaminants, light, or other detrimental influences.

15 It would be far more convenient and effective to store, meter, blend, and dispense several substances from a single container. The prior art has proposed containers which dispense plural contents. An example is seen in United States Patent Number 3,850,346, issued to
20 James E. Richardson et al. on November 26, 1974. The subject dispenser of Richardson et al. is hand squeezed to dispense fluids, whereas the present invention includes a plunger pump. Also, the present invention has an internal dispensing flow circuit incorporating pick up

tubes, a mixing chamber, and check valves not seen in Richardson et al.

United States Patent Number 5,439,137, issued to Jean-Francois Grollier et al. on August 8, 1995, shows an
5 aerosol type dispenser having plural fluid containers which dispense fluid. Unlike the present invention, there is no manual pump and no proportional control of substances being dispensed.

United States Patent Number 5,127,548, issued to
10 Michel Brunet et al. on July 7, 1992, features a dispenser having a plunger pump at one end and a discharge nozzle at the other end, in the manner of a hypodermic syringe. Actuation of the plunger ruptures a barrier which separates two stored fluids. The present
15 invention lacks a frangible barrier which would require renewing for each subsequent use. Also, there is no mixing circuit incorporating check valves, as seen in the present invention, and no proportional control of substances being dispensed. In the present invention,
20 fluid is discharged through the pump, whereas this arrangement is not possible in the device of Brunet et al.

United States Patent Number 5,588,550, issued to Robert C. Meyer on December 31, 1996, illustrates a
25 compartmented container which dispenses plural fluids in

adjustable proportion. However, Meyer lacks a plunger pump and a dispensing circuit having check valves and an internal mixing chamber, as seen in the present invention.

5 United States Patent Number 5,890,624, issued to William M. Klima et al. on April 6, 1999, shows a dispensing container providing plural storage compartments and an indirectly operated plunger pump. Klima et al. has a dispensing circuit incorporating check
10 valves and a mixing chamber. However, Klima et al. lacks proportional control of fluids being dispensed, an agitator or mixing structure carried on the piston of the pump, and an internal support for supporting one of the storage compartments within the container. By contrast,
15 these features are all seen in the present invention. Klima et al. has a plunger type pump. However, this pump is indirectly actuated by a trigger and associated linkage, whereas the pump of the present invention is directly actuated.

20 None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

SUMMARY OF THE INVENTION

The present invention affords a hand held, pump action dispensing container which is suitable for enabling consumers to dispense many different fluids.

5 The novel container has a storage receptacle in the form of a jar or bottle open at the top only, and threads for securing a cap which bears a discharge nozzle. The storage receptacle is divided into several compartments each intended to contain one fluid. The compartments
10 are, in different embodiments, arranged side by side, one above the other, or one within another. These fluids may be mixed in any desired proportion prior to discharge. The fluids are mixed or blended internally within the container prior to discharge.

15 A dispensing circuit enclosed within the container has a pick up tube for each container, a common mixing chamber, and check valves to prevent cross contamination of storage compartments by backflow within the mixing circuit and to isolate the mixing chamber from exposure
20 to the outside atmosphere.

The dispensing circuit and its conduits are secured to the cap. A plunger type pump is incorporated into the dispensing circuit. The plunger pump operates by direct action, that is, its upper portion is contacted by the
25 user's hand and depressed. Depressing the plunger

directly pressurizes fluid contained in the mixing chamber. Pressurized fluid can escape only through the discharge nozzle. A spring returns the plunger to its original position where it is ready for the next
5 pressurizing stroke. The return stroke generates a partial vacuum in the mixing chamber which recharges the mixing chamber with fluids retrieved from storage. A proportioning valve adjusts proportions of fluids retrieved from storage.

10 Optionally, paddles or vanes are carried on the pump to improve blending within the mixing chamber. This option is used when highly viscous fluids are to be mixed, or when dispensing any fluids which resist spontaneous mixing. In a further option, a support cage
15 or frame for supporting a small storage container within the bottle or jar depends from the cap.

A significant advantage of the invention is that pre-existing spray bottles can be readily converted to include a blending feature. This is of interest to
20 manufacturers who will be able to utilize existing tooling to fabricate the storage receptacle and much of the spray head. This is possible because the mixing chamber and a storage chamber for the second fluid are attachable to the cap. Both are inserted into a
25 manufacturer's standard bottle, thereby providing a spray

pump dispenser which stores and blends two different fluids.

Accordingly, it is an object of the invention to provide a hand held dispenser which blends and dispenses plural fluids which must be stored separated from one another.

It is another object of the invention to enable adjustment of proportions of the fluids being dispensed.

It is a further object of the invention to provide a mixing chamber for mixing fluids, which mixing chamber is isolated from the outside atmosphere.

Yet another object of the invention is to provide apparatus enabling standard pump spray dispensers to be readily converted from single fluid operation to blending and dispensing operation.

Still another object of the invention is to prevent contamination of each stored fluid by another stored fluid by backflow within the mixing circuit.

An additional object of the invention is to provide agitators for enhancing mixing and blending of viscous fluids in the mixing chamber.

It is a further object of the invention to provide support structure for supporting a small storage container depending from the cap.

Yet another object of the invention is to provide direct actuation of the pressurizing plunger, and to discharge pressurized fluids through the cap.

5 It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

10 These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features, and attendant advantages of the present invention will become more fully appreciated as the same becomes better understood
15 when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

20 Fig. 1 is a partially exploded, cross sectional, side elevational view of the invention.

Fig. 2 is a cross sectional, side elevational view of a second embodiment of the invention.

Figs. 3 and 4 are top plan detail views of the upper center of Fig. 1, wherein Fig. 4 shows an adjustment from

the positions shown in Fig. 3, made by mutually rotating the components relative to one another.

Fig. 5 is a top plan view of the invention.

Fig. 6 is a side elevational, cross sectional view
5 of an alternative embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to Fig. 1 of the drawings, novel dispensing container 10 is seen to comprise a storage bottle 12 having a floor 14, a lateral wall 16, and an
10 open upper end 18. A receptacle 20 for storing a fluid for subsequent dispensing is defined within bottle 12. Container 10 stores two fluids separately, and can blend these fluids immediately prior to dispensing. A second receptacle 22 is defined within storage vessel 24.
15 Storage vessel 24 is dimensioned and configured to be insertable into, contained within, and readily retrieved from receptacle 20.

A cap 26 closely engages upper end 18 of storage bottle 12. Components of a mixing and dispensing circuit
20 and a pump for pressurizing fluids being dispensed are carried on cap 26. The mixing and dispensing circuit includes a first pick up tube 28 extending from cap 26 into receptacle 20, terminating near floor 14. A second pick up tube 30 depends from cap 26, extending to near

10

the bottom of receptacle 22 of storage vessel 24. Pick up tubes 28, 30 discharge their respective retrieved fluids into a mixing chamber 32.

Mixing chamber 32 is defined within a generally cylindrical member 34. A pump is provided by a plunger 36 which is slidably disposed within cylindrical member 34 and accessible to manual contact from above cap 26. The pump pressurizes and propels fluids contained within mixing chamber 32. Plunger 36 includes a head 38 formed to define structure which cooperates with a user's thumb or finger, and a discharge nozzle 40 opening to the outside atmosphere. Circumferential ribs 41 project outwardly from plunger 36 at that portion contacting the interior surface of member 34, for improving engagement of an external object. Illustratively, it is easy to grasp plunger 36 manually when assembling container 10 when ribs 41 engage the fingertips. The function of member 34 will be described hereinafter.

The dispensing circuit includes a first conduit 42 formed in pick up tube 28, a second conduit 44 formed in pick up tube 30, mixing chamber 32, and a discharge conduit 46 formed in head 38 of plunger 36. Discharge conduit 46 is disposed to conduct pressurized fluid from the pump to discharge nozzle 46. Conduits 42, 44, and 46 are disposed in fluid communication with chamber 32,

subject to respective check valves 48, 50, 52. Check valves 48, 50 prevent back flow of blended fluids from chamber 32 into their respective receptacles 20, 22, to preclude cross contamination of stored fluids. Check
5 valve 52 closes chamber 32 to fluid communication with the outside atmosphere, thereby minimizing possible deterioration of mixed fluids due to contact with air and airborne contaminants.

When plunger 36 is depressed by the user from the
10 ready position shown in Fig. 1, plunger 36 imposes pressure on fluids contained within chamber 32. These fluids can escape only through conduit 46, and are subsequently discharged through nozzle 46. A return spring 54 urges plunger 36 upwardly towards the ready
15 position, thereby generating a partial vacuum within chamber 32. This vacuum draws fluids from receptacles 20, 22 past check valves 48, 50 into chamber 32.

Plunger 36 performs the further function of actively mixing or blending fluids drawn into chamber 32. Mixing
20 vanes or blades 56 project downwardly from plunger 36 such that they have a tendency to stir and mix fluids in chamber 32.

A support cage or frame 58 is attached to that portion 60 of cap 26 projecting into receptacle 20 of

12

bottle 12. Support frame 58 surrounds vessel 24 and retains vessel 24 against portion 60 of cap 26.

In the embodiment of Fig. 1, vessel 24 is contained within receptacle 20 of bottle 12, and is removed therefrom by withdrawing cap 26. Cap 26 has threads 62 which engagingly mate with threads 64 formed in bottle 12. Pick up tube 28 passes through an upper opening 66 and a lower opening 68 formed in vessel 24 so that pick up tube 28 has access to fluid stored below vessel 24 in receptacle 20. Vessel 24 and pick up tubes 28, 30 are withdrawn from bottle 12 when cap 26 is unthreaded and removed.

Referring now to Fig. 2, in another embodiment of the invention, container 110 has two fluid storage receptacles 120, 122 formed in bottle 112. Receptacles 120, 122 are separated from one another by an interior partition wall 102. Bottle 112 is closed by cap 126. Pitch of threads 162, 164 is modified from the embodiment of Fig. 1 so that cap 126 is fully installed prior to interference occurring between pick up tubes 128, 130 with wall 102. Wall 102 and the bottom portion 160 of plunger 136 are dimensioned and configured so that lower portion 160 of plunger 136 contacts wall 102, thereby sealing and separating receptacles 120, 122.

Cap 126 carries a member 134 and a plunger 136, which are both essentially similar to member 34 and plunger 36 of Fig. 1. The only difference between the embodiments of Fig. 1 and Fig. 2 is that receptacles 120, 122 in Fig. 2 are both formed integrally with bottle 112. Optional mixing blades 41 are omitted from the embodiment of Fig. 2. The embodiment of Fig. 2 is appropriate where the proportions of the two fluids approach equality in the blended mix.

Both embodiments incorporate an adjustable proportioning valve disposed to selectively vary proportions of fluids entering the mixing chamber. This feature will be described in terms of the embodiment of Fig. 1, although it will be understood that the operative principles are equally applicable to the embodiment of Fig. 2. Turning now to Fig. 3, floor 70 of member 34 is seen to have an arcuate opening 72 which exposes upper opening 74 of conduit 42 (see Fig. 1) and upper opening 76 of conduit 44 (see Fig. 1) to fluid communication with chamber 32. Member 34 may be grasped by a knurled, ridged, or otherwise textured collar or flange 78 (see also Fig. 1) and rotated to vary the cross sectional exposed area of openings 74, 76. Member 34 is rotatably contained within section 60 of plunger 26 so that this adjustment is possible.

Fig. 4 shows adjustment which has been made from the relative positions of member 34 and the bottom of portion 60 of cap 26 originally shown in Fig. 3. In Fig. 3, opening 74 is fully uncovered, and opening 76 is partially obstructed by floor 70 of member 34. In Fig. 4, member 34 has been rotated in the direction of arrow 80 with the result that opening 74 is now partially obstructed and opening 76 is fully open. The proportions of respective fluids which will be drawn into chamber 32 by suction on the return stroke of plunger 36 will vary accordingly. Proportions of fluids entering chamber 32 are therefore infinitely adjustable within the range enabled by the cross sectional area of conduits 42, 44 and opening 72.

Fig. 5 shows the externally visible components of container 10, as they relate to adjustment of proportion of the fluid mix. A pointer 82 formed in flange 78 is arranged to align with index marks of an index scale 84 molded into or printed on cap 26. Rotation of member 34 in directions indicated by arrow 86 by grasping flange 78 will be reflected by different relative positions of pointer 82 and scale 84.

Fig. 6 shows an embodiment particularly adapted for modification of pre-existing spray dispensers not originally designed to incorporate blending features.

Container 210 includes a storage bottle 212 having a floor 214, a lateral wall 216, and an upper edge 218. A receptacle 220 for storing a fluid for subsequent dispensing is defined within bottle 212. A second
5 receptacle 222 is defined within storage vessel 224. Storage vessel 224 is dimensioned and configured to be insertable into, contained within, and readily retrieved from receptacle 220.

10 The embodiment of Fig. 6 departs from that of Fig. 1 in that vessel 224 is configured to be supported from upper edge 218. To this end, vessel 224 has a flange 225 which will come to rest on upper edge 218 when vessel 224 is inserted into receptacle 220 of bottle 212. Cap 226 has a horizontal member 227 which entraps flange 225 when
15 cap 226 is threaded to bottle 212.

20 The spray pump of the embodiment of Fig. 6 operates similarly to that of Fig. 1, but is adapted to be compatible with vessel 224. A mixing chamber 232 is formed within a housing 234 formed at the top of vessel 224. A first pick up tube 228 depends from member 234 and passes through vessel 224. A telescopic tubular extension 235 extends nearly to the floor 214 of bottle 212. Fluid drawn by suction from the pump will enter extension 235, pass through pick up tube 228, and pass by
25 check valve 248 to enter mixing chamber 232. A second

pick up tube 230 depends from member 234 and extends nearly to the bottom of vessel 224. Fluid drawn by suction from vessel 224 is conducted through tube 230 past check valve 250 to enter mixing chamber 232.

5 The pump of container 210 includes a plunger 236 slidably disposed on cap 226 and a head 238 which is the equivalent of that of the embodiment of Fig. 1. A housing 233 acts in concert with cap 236 to form a suction chamber 237 which is in fluid communication with
10 mixing chamber 232. A check valve 252 carried in housing 233 separates mixing chamber 232 from suction chamber 237. Preferably, check valves 248, 250, and 252 each have a spring urging the respective valve into the closed position. These springs are sufficiently weak so that
15 their associated valves will open responsive to suction established when plunger 236 moves upwardly responsive to return spring 254 after the user has removed manual pressure from plunger 236. Container 210 has a dispensing circuit including the conduit provided by pick
20 up tubes 228, 230, mixing chamber 232, suction chamber 233, and a discharge conduit 246 formed in head 238. The overall function of the dispensing circuit of container 210 is similar to that of container 10 as regards pumping action, check valve operation, retrieval of fluids from
25 receptacles 220, 222, and dispensing of blended fluids

under pressure from the pump. The pump utilizes plunger 236 in a manner similar to that of plunger 36 of container 10. In container 210, blending may occur in chamber 237 as well as in chamber 232. The significant
5 advantage of container 210 is that insertion of vessel 224 into bottle 212 readily converts a standard pump dispensing container (not shown) into a blending dispensing container. Most of head 238 and plunger 236 can be adapted for use in container 210, this requiring a
10 limited degree of truncation of the original suction chamber and downwardly depending portion thereof from the original head and plunger (not shown).

Progressive depletion of fluids stored in the various receptacles of all embodiments may be
15 accommodated in any suitable way. Air relief valves (not shown) may be incorporated where desired. A source of compressed gas may be provided to prevent collapse or inoperability upon depletion of stored fluids. Alternatively, one or more receptacles may be flexible,
20 so that they collapse in controlled fashion as their contents are removed.

The invention is susceptible to modifications and variations which may be introduced without departing from the inventive concept. For example, the number of fluid
25 storage receptacles could be increased beyond the two

shown in the principal embodiments, with appropriate branching of the resulting mixing circuit and increase in the number of pick up tubes or their equivalents. In another example, the ball type check valves shown and
5 described prior could be replaced by membrane valves which distend to open when subjected to pressurized fluid, but which close when not subjected to pressurized fluid from the intended direction of flow.

In still other embodiments, the cap may snap fit to
10 the bottle rather than thread thereto. The mixing blades shown in Fig. 1 could be modified in their number, location, dimensions, and configuration. Also, the plunger pump described herein may be replaced or supplemented by the use of propellant gas, vacuum, or a
15 powered pump. Return spring 54 may be replaced by plural return springs.

It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

CLAIMS

I claim:

1. A dispensing container for storing fluids separately and blending and dispensing these fluids, comprising:

a storage bottle having a floor, a lateral wall, an open upper end, and a first receptacle;

a storage vessel dimensioned and configured to be insertable into and contained within said storage bottle, said storage vessel having a second receptacle; and

a cap closingly engageable with said upper end of said storage bottle, said cap having a mixing and dispensing circuit including

a pick up conduit communicating with said first receptacle of said storage bottle,

a pick up tube extending from said cap to said second receptacle,

a mixing chamber disposed in fluid communication with said first pick up tube and said pick up conduit,

a pump disposed to pressurize and propel fluids contained within said mixing chamber,

a discharge nozzle opening to the outside atmosphere,

a discharge conduit disposed to conduct pressurized fluid from said pump to said discharge nozzle, and

an adjustable proportioning valve disposed to selectively vary proportions of fluids entering said mixing chamber.

2. The dispensing container according to claim 1, wherein said mixing circuit includes a first check valve disposed between said mixing chamber and said discharge nozzle, wherein said first check valve prevents backflow into said mixing chamber.

3. The dispensing container according to claim 1, wherein said mixing circuit includes a second check valve disposed between said first receptacle and said mixing chamber to prevent backflow into said first receptacle, and a third check valve disposed between said second receptacle and said mixing chamber to prevent backflow into said second receptacle.

4. The dispensing container according to claim 1, wherein said pump comprises a plunger accessible to manual contact from above said cap.

5. The dispensing container according to claim 1, wherein said plunger has circumferential ribs for improving engagement of an external object.

6. The dispensing container according to claim 4, further comprising a return spring disposed to urge said plunger towards a ready position.

7. The dispensing container according to claim 4, wherein said plunger has mixing blades projecting therefrom.

8. The dispensing container according to claim 1, wherein said storage vessel is attached to said cap and occupies said first receptacle of said storage bottle.

9. The dispensing container according to claim 8, further comprising a support frame mounted to said cap, projecting into said first receptacle of said storage bottle, and disposed to surround and support said storage vessel.

10. A dispensing container for storing fluids separately and blending and dispensing these fluids, comprising:

a storage bottle having a floor, a lateral wall, an upper edge, and a first receptacle enclosed within said floor and lateral wall;

a storage vessel dimensioned and configured to be insertable into and contained within said storage bottle, said storage vessel enclosing a second receptacle, wherein said storage vessel includes an upwardly and

outwardly projecting flange dimensioned and configured to overlie said upper edge of said storage bottle; and

a cap closingly engageable with said upper end of said storage bottle, said cap having a horizontal member disposed in overlying relationship relative to said flange of said storage vessel, whereby said flange is entrapped between said storage bottle and said cap when said cap is mounted on said storage bottle, and a mixing and dispensing circuit including

a first pick up conduit communicating with said first receptacle of said storage bottle,

a second pick up conduit extending from said cap to said second receptacle of said storage vessel,

a mixing chamber disposed in fluid communication with said first pick up tube and said pick up conduit,

a pump disposed to pressurize and propel fluids contained within said mixing chamber,

a discharge nozzle opening to the outside atmosphere,

a discharge conduit disposed to conduct pressurized fluid from said pump to said discharge nozzle, and

an adjustable proportioning valve disposed to selectively vary proportions of fluids entering said mixing chamber.

11. The dispensing container according to claim 10, wherein said first pick up conduit extends through said storage vessel and terminates in said first receptacle of said storage bottle.

12. The dispensing container according to claim 10, wherein wherein said mixing circuit includes

a first check valve disposed between said mixing chamber and said discharge nozzle, wherein said first check valve is carried on said cap and prevents backflow into said mixing chamber,

a second check valve disposed between said first receptacle and said mixing chamber to prevent backflow into said first receptacle, and

a third check valve disposed between said second receptacle and said mixing chamber to prevent backflow into said second receptacle.

13. A dispensing container for storing fluids separately and blending and dispensing these fluids, comprising:

a storage bottle having a floor, a lateral wall, an open upper end, open space defined within said lateral wall, and an interior partitioning wall dividing said

interior space into a first receptacle opening to said open upper end of said storage bottle and a second receptacle opening to said open upper end of said storage bottle; and

a cap closingly engageable with said upper end of said storage bottle, said cap having a mixing and dispensing circuit including

a first pick up conduit communicating with said first receptacle of said storage bottle,

a second pick up conduit communicating with said second receptacle of said storage bottle,

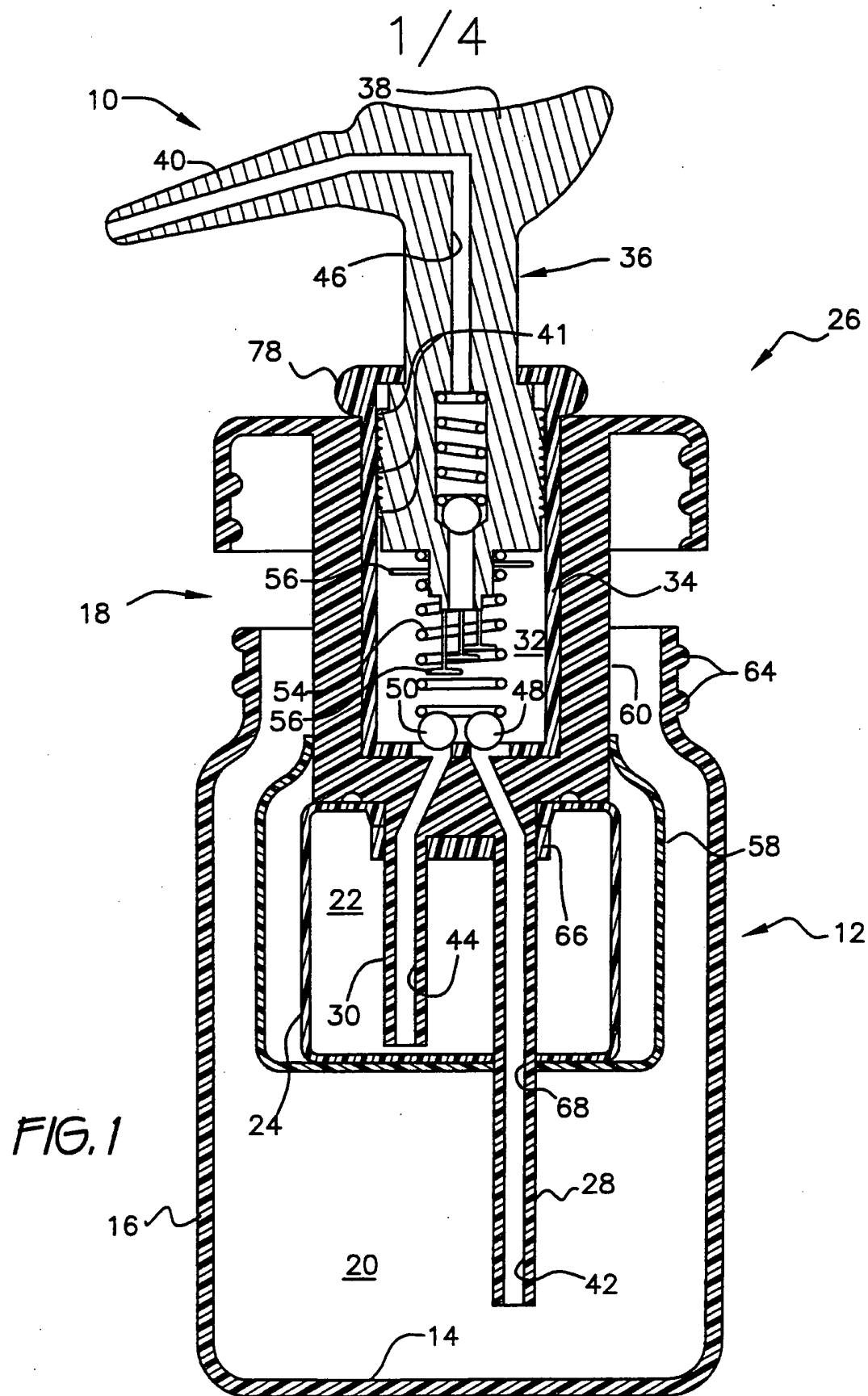
a mixing chamber disposed in fluid communication with said first pick up conduit and said second pick up conduit,

a pump disposed to pressurize and propel fluids contained within said mixing chamber,

a discharge nozzle opening to the outside atmosphere,

a discharge conduit disposed to conduct pressurized fluid from said pump to said discharge nozzle, and

an adjustable proportioning valve disposed to selectively vary proportions of fluids entering said mixing chamber.



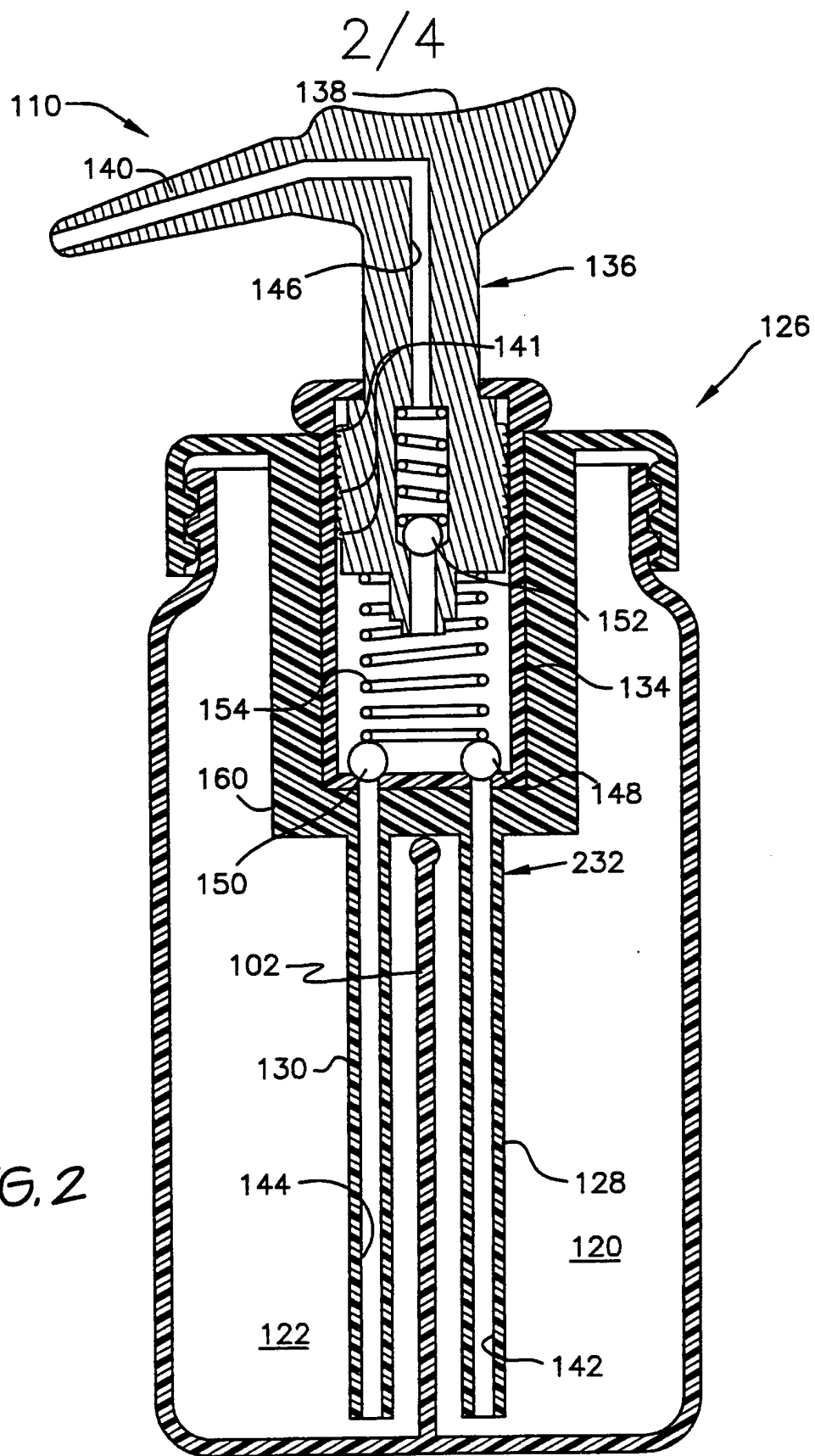


FIG. 2

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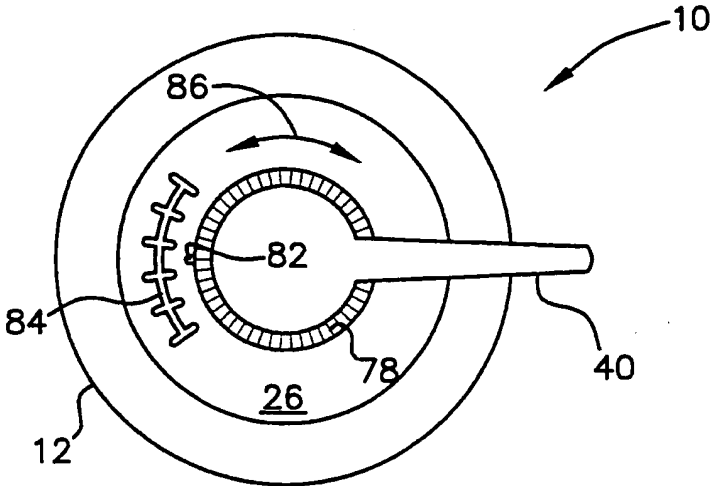


FIG. 5

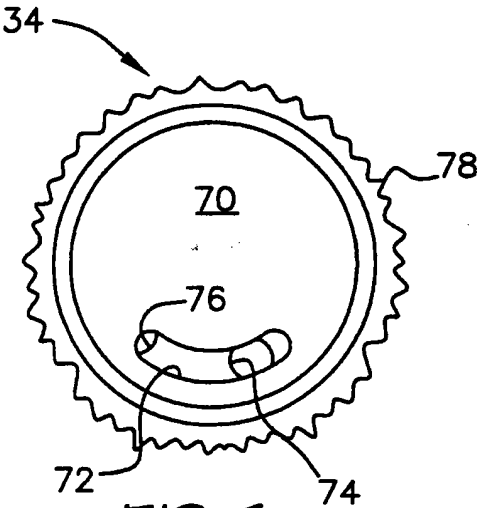


FIG. 3

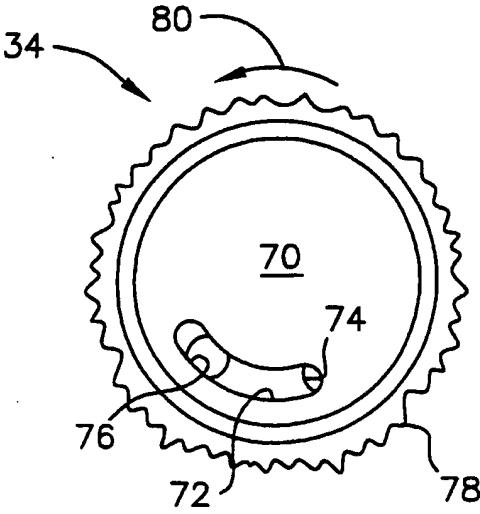
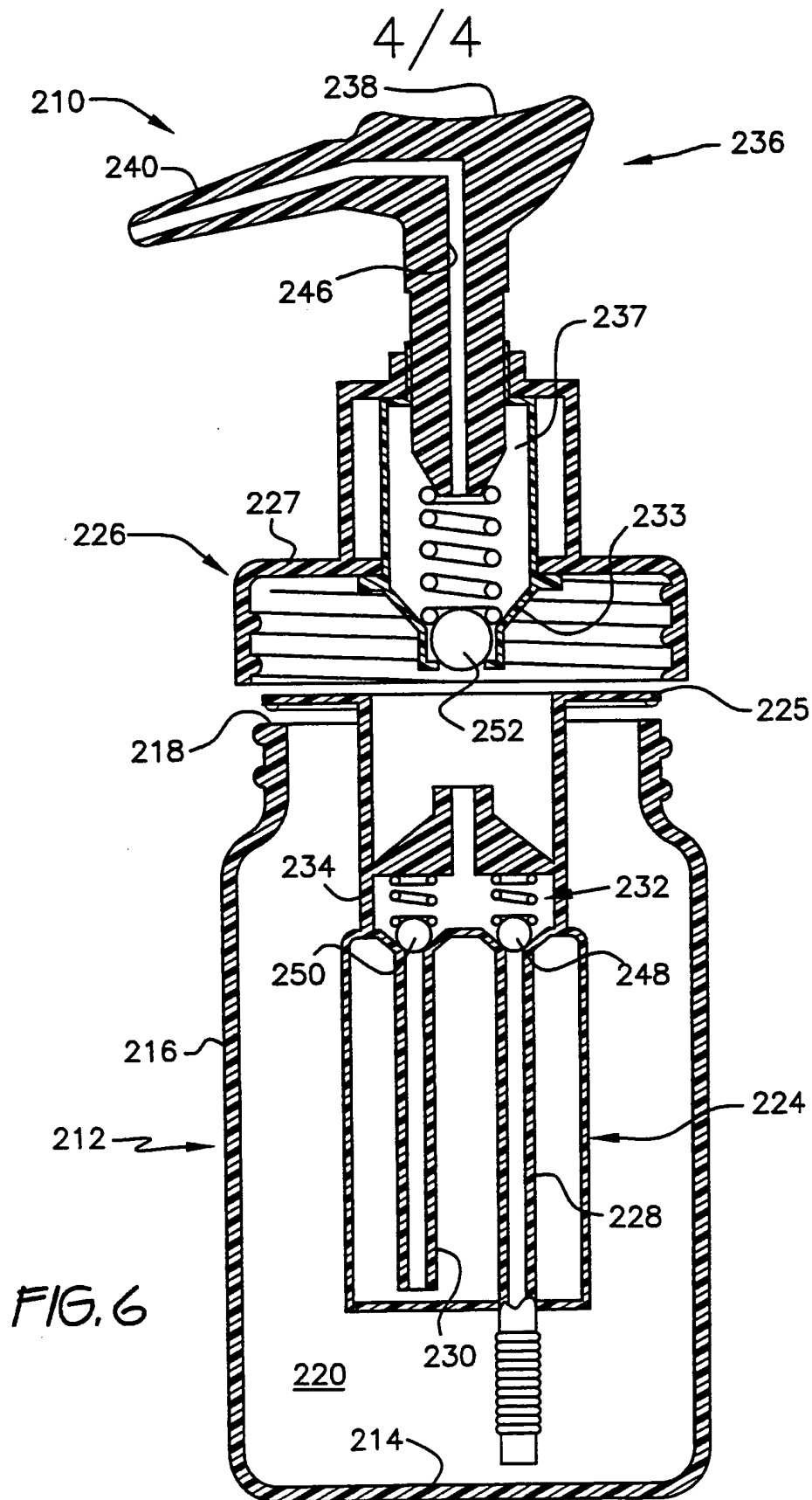


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/16300

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) :B67D 5/52 US CL :222/136, 145.8, 321.7 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 222/136, 145.4-145.8, 321.4, 321.7 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,385,270 A (CATANEO et al.) 31 January 1995, see entire document.	13 — 1-6, 8, 10-12
Y	US 5,890,624 A (KLIMA et al.) 06 April 1999, see entire document.	1-6, 8, 10-12
A	US 5,009,342 A (LAWRENCE et al.) 23 April 1991, see entire document.	1-13
A	US 5,848,732 A (BRUGGER) 15 December 1998, see entire document.	1-13
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search 31 AUGUST 2000		Date of mailing of the international search report 12 OCT 2000
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